

REMARKS

This is in response to the Office Action dated February 09, 2005, which rejected Claims 1-34 under 35 U.S.C. 103(a) as being unpatentable over Chen (6697550). The rejection is respectfully traversed based on the following remarks, and it is respectfully submitted that all the pending claims are patentable.

The Amended Claims

Claims 1 and 32 have been amended to correct the typos.

In Claim 20, the material for fabricating the electronically modulated prism is amended to be operative to induce a gradient of optical-path difference for the incident beam and changes of refractive index at selected positions of the material by applying an electric field at the selected positions across the material locally. Such features have been disclosed in many places of the specification as originally filed. For example, as disclosed at the last four lines of paragraph [0036] in page 10, *"the electronically modulated prism as shown in Figure 5 is not only operative to provide the gradient of the optical-path difference $L(x)$, but is also operative to adjust the refractive index thereof."*

Rejection Under 35 U.S.C. 103(a)

Claims 1-34 were rejected under 35 U.S.C. 103(a) as being unpatentable over Chen (6697550).

For Claims 1, 12, 20, 22, 25, 32, the Examiner contended *"Chen in figs. 4A-4C and in col. 2, line 37 describes an electro-optical prism steers a beam of light depending on the voltage applied (see also col. 4, lines 15-20) but does not specifically refer to an array of electrode pads. However, in col. 7, lines 14-35 there is a discussion of a deflector that has multiple voltages that can be applied and therefore multiple pads. It would have been obvious to one of ordinary skill in the art to use an array of pads in the deflecting bulk crystal because one could apply varying voltages which would give flexibility in how much to bend the beam. In col. 2, lines 37, Chen discusses various material used in the crystal, for example, lithium niobate. The shape of the crystal and the direction of the beam are design*

choices that one skilled in the art would choose depending on the system requirements and can be found by routine experimentation.”

Claims 1 and 12

In the independent claims 1 and 12, a beam steering system including an electronically modulated prism and an electronically modulated prism are disclosed, respectively. The electronically modulated prism comprises a bulk crystal that has an array of electrodes deposited on the top surface thereof and a common electrode formed on the bottom surface thereof. The electronically modulated prism further comprises an electric field source operative to apply an adjustable electric field to each electrode of the array. Apparently, as the bulk crystal is comprised by the prism, **this specific prism comprises the array of electrodes formed on the bulk crystal**. In other words, **the array of electrodes is formed on the same prism**. Therefore, by adjusting the electric field applied to the electrodes, refractive index at desired positions of the prism can be changed, and/or a gradient of optical-path difference for the incident beam can also be adjusted as desired.

Chen discloses a deflector 16 that includes one or a plurality of prisms. The only disclosure that the deflector 16 being formed of a single prism is found in col. 2, lines 38-40, which teaches “*In certain embodiments, the E-O deflector includes a prism having an index of refraction that changes as **an electric field is applied across the prism***”. Such teaching does not explicitly or inherently suggest that a single prism can be subjected to more than one electric field at various positions thereof. On the contrary, it appears that when the deflector is made of only one prism, only one voltage is applied across the deflector. There is no desirability of forming more than one electrode pad on the same prism from such teaching.

In col. 2, lines 45-49, Chen further discloses “*Some switches have an E-O deflector having two or more prisms. In some embodiments, the prisms have linear E-O properties such that the deflection of the two beams produced by the prisms is additive when the electric field applied to each prism has the same polarity*”. Further in col. 7, lines 2-4, 15-16, and Figures 1 and 4A-4C, Chen discloses a deflector 16 including a plurality of prisms (60-64, 70-74 and 80-84) with opposite domains, and **each of the prisms includes only one pair of electrode pad**. For example, in Figure 4A(i), each of the prisms 60, 62, 64, and 66 includes the electrode pads 60a and 60b, 62a and 62b, 64a and 64b, and 66a and 66b, respectively.

Thereby, each of the prisms 60, 62, 64 and 66 can be subjected to an electric field V2, V4, V1 and V3, respectively. Figures 4B and 4C also shows a deflector 16 including a plurality of prisms (70-76 and 80-86), and each of the prisms includes only on pair of electrode subjected to the same electric field.

As disclosed by Chen, the only condition that allows multiple voltages applied to the deflector is when the deflector comprises multiple prisms, and each of the prism only have a pair of electrodes. Chen also explicitly shows that, in Figures 4A to 4C, the electrodes covering the whole top surfaces of the prisms. Consequently, the electric field applied to each prism is applied across the whole prism. That is, **the whole prism is subjected to the same electric field.**

Therefore, in either case (the deflector made of a single prism or multiple prisms), Chen fails to teach an array of electrodes formed on the same prism. Chen also fails to suggest to apply an electric field at selected positions of the prism. On the contrary, Chen explicitly discloses that an electric field is applied across the prism. Therefore, there is no motivation for Chen to modify the deflector by incorporating an array of electrodes on the same prism as claimed in Claims 1 and 12. The rejection is thus believed based on hindsight.

As Chen fails to teach the motivation or suggestion of an array of electrodes formed on the same prism, a *prima facie* case of obviousness is not established. Claims 1, 12 and the dependent Claims 2-11 and 13-19 are patentable.

Claim 20

In Claim 20, an electronically modulated prism is disclosed. The prism is fabricated from a material operative to induce a gradient optical-path difference of an incident beam and changes of refractive index at selected positions by applying an electric field at the selected positions across the material locally. Similarly to Claims 1 and 12, the prism is operative induce changes of refractive index at selected positions of the same prism.

As discussed above, Chen discloses a deflector including one or more than one prism. In either case, each prism includes only one pair of electrodes covering the whole top surface thereof; and therefore, each prism is subjected to the same electric field, and the same electric field is applied across the whole prism. Consequently, the refractive index of the whole

prism is changed. The prism disclosed by Chen does not allow changes of refractive index at selective positions of any of the prisms.

Further, all the embodiments (Figures 1 and 4A-4C) disclosed by Chen provide a constant effective length, that is, a constant optical-path difference for each prism or the deflector. As specifically disclosed in col. 8, lines 46 to 64 by Chen, when the electric field applied to the prism induced a change of refractive index Δn , while optical-path difference L remains constant.

Therefore, Chen does not only fails to teach the prism operative to induce changes of refractive index at selected positions of the same prism, but also fails to teach the prism operative to induce a gradient of optical-path difference as claimed in Claim 20. The rejection over Claim 20 and its dependent Claim 21 is thus respectfully traversed.

Claim 22

Claim 22 discloses a beam steering system in which a prism is fabricated from a material operative to induce a plurality of local phase shifts of an incident beam at various positions and accumulate the local phase shifts. Chen discloses an overall change of refractive index for each prism only. There is no suggestion or motivation for modifying Chen by incorporating a plurality of local phase shifts at various positions of the same prism.

Therefore, Claims 22-24 are patentable over Chen.

Claim 25

In Claim 25, a method of steering a beam is disclosed. In this method, one prism is fabricated from an electro-optical material. To steer a beam propagate laterally through the prism, an electrically field is applied locally at various positions across the same prism. Similarly to Claims 1 and 12, Chen teaches one or more than one prism each being subjected to the same electric field. There is no motivation or suggestion for Chen to apply electric field locally at various positions across the same prism. Therefore, the rejection over Claims 25 and its dependent Claims 26-31 is respectfully traversed.

Claim 32

Claim 32 discloses a method of steering an incident beam, which includes a step of forming at least one propagating interface of the incident beam **within** the bulk crystal by applying an electric field with a first intensity at selected positions across the bulk crystal.

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As clearly shown in Figures 1 and 4A-4C, the only propagation interfaces disclosed by Chen include the interfaces (indicated by solid lines between 16a, 16b, 16c in Figure 1 and blank areas between 60-66, 70-76 and 80-84 in Figures 4A to 4C). Chen fails to disclose any propagation interface formed within any of the prism. In addition, all the interfaces disclosed by Chen always exist no matter whether the respective electric fields are applied to the prisms 16a, 16b or 16c or not. That is, application of electric field to any of the prisms does not create an interface; or in other words, the interfaces are not formed by applying electric field to any of the prisms 16a, 16b and 16c. Chen does not only fail to teach a plurality of electrode pads, but also fail to teach the electrode pads so arranged to create an interface within the prism.

Therefore, a *prima facie* case of obviousness is not established, and the rejection over Claims 32-34 is respectfully traversed.

If any additional fee is required, please charge Deposit Account Number 19-4330.

Respectfully submitted,

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